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CONTROL ID: 1810343

TITLE: The Face that Launched a Thousand Slips

ABSTRACT BODY: Helene, (~17.6 km mean radius) is a L4 Trojan co-orbital of Saturn's moon Dione. Its hemisphere features an unusual morphology consisting of broad depressions and a generally smooth surface patterned with streaks and grooves. The streaks appear to be oriented down-gradient, as are the grooves. This pattern suggests intensive mass-wasting as a dominant process on the leading hemisphere. Kilometer-scale impact craters are very sparse on the leading hemisphere other than the degraded km-scale basins defining the overall satellite shape, and many small craters have a diffuse appearance suggesting ongoing mass wasting. Thus mass wasting must dominate surface-modifying processes at present. In fact, the mass wasting appears to have been sufficient in magnitude to narrow the divides between adjacent basins to narrow septa, similar, but in lower relief, to the honeycomb pattern of Hyperion. The prominent groves occur primarily near topographic divides and appear have cut into a broad, slightly lower albedo surface largely conforming to the present topography but elevated a few meters above the smooth surfaces undergoing mass wasting flow. Low ridges and albedo markings on the surface suggest surface flow of materials traveling up to several kilometers. Diffusive mass wasting produces smooth surfaces - such a pattern characterizes most of the low-lying surfaces. The grooves, however, imply that the transport process is advective at those locations where they occur, that is, erosion tends to concentrate along linear pathways separated by divides. In fact, in many places grooves have a fairly regular spacing of 125-160 m, defining a characteristic erosional scale. Several questions are prompted by the unusual morphology of Helene: 1) What is the nature of the surface materials? 2) Are the transport processes gradual or catastrophic motion from one or a few events? 3) What mechanisms drive mass wasting and groove development? 4) Have the formative processes been active in the recent past? 5) Finally, is the surface accreting or eroding? The smooth character of the leading edge hemisphere of Helene and the dominance of mass wasting suggest that the surface is composed of fine-grained debris, probably dominated by dust-size to small gravel particles. The Lagrangian points of saturnian satellites are locations where planetesimals might have accreted to form co-orbital satellites such as and they may capture ejecta from their master moon. Published models suggest that Helene is a site of net accretion, but we find no extant explanation for the dominance of fine grain sizes for the surface (and probable subsurface) composition of Helene and the other Lagrangian satellites. Observation of the mass wasting tracks on Helene suggests the presence of well-defined streams of debris with low bordering levees that may be depositional features or remnants of the dissected higher surface. Some flows in grazing illumination appear to have a convex cross-section. This mass-flow morphology might be consistent with the occurrence of large-scale flow events, but which might have occurred through rapid emplacement or slow glacier-like creep. On the other hand, small craters appear to have been "softened" by creep-like processes, indicating ongoing mass wasting.

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